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BALLY MANUFACTURING CORPORATION, a Delaware corporation,

Plaintiff/Counterdefendant,

vs.

D. GOTTLIEB & CO., a corporation, WILLIAMS ELECTRONICS, INC., a corporation, and ROCKWELL INTERNATIONAL CORPORATION,

Defendants/Counterplaintiffs.

) Docket No.
) 78 C 2246
)
) Chicago, Illinois
) January 31, 1984
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VOLUME XII-A
TRANSCRIPT OF PROCEEDINGS
BEFORE THE HONORABLE JOHN F. GRADY

TRANSCRIPT ORDERED BY: MR. JEROLD B. SCHNAYER
MR. MELVIN M. GOLDENBERG

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For the Plaintiff/Counterdefendant: MR. KATZ
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MR. TONE
MR. SIGEL

For the Defendants/Counterplaintiffs: MR. LYNCH
MR. HARDING
MR. LEACH
MR. GOLDENBERG
MR. ELLIOTT
MR. RIFKIN
MR. GOTTLIEB

Court Reporter: LAURA M. BRENNAN
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THE COURT: Good morning, counsel.

MR. LYNCH: Good morning, your Honor.

MR. TONE: Good morning, your Honor.

MR. SCHNAYER: Good morning, your Honor.

THE COURT: I have bad news about our schedule.

This is the last day of the Speedy Trial Act on a criminal case that I've been hoping would plead out. It's not going to happen. And I've got them set for 2:00 o'clock this afternoon to pick a jury, and it will take the rest of the week, as far as I know.

So we've got the morning and that's it until March.

I really was very optimistic that this case was not going to go ahead.

MR. TONE: Is there any chance that it won't last the week, your Honor?

THE COURT: Apparently not.

Well, yes, there's a chance; but, I mean, the probability is that it will end sometime Friday.

What if we get into it and it looks like it's going to end Thursday; do you want to come back Friday?

MR. TONE: We would like to.

I recognize Mr. Lynch has a different problem because he's from out of town.

MR. LYNCH: Well, your Honor --

THE COURT: I won't get you back here for one day.

MR. LYNCH: If it's for a full day, I think it would be worth it, your Honor, if it's really for a full day. I mean, may it please the Court, if it's going to be for a couple of hours --

THE COURT: Right.

MR. LYNCH: If we're going to get six full trial hours in, or something like that, I guess I'd be willing to do that.

THE COURT: Well, if we can do that, we will. If not, we'll just go over until March.

MR. TONE: All right, good. And if we can --

THE COURT: Whenever it was we had agreed we'd resume.

MR. TONE: Good. We'll hold the time, then, in case we can get at least a full day in.

THE COURT: Fine.

Good morning.

THE WITNESS: Good morning.

JAMES SCHOEFFLER, PLAINTIFF'S WITNESS, PREVIOUSLY SWORN.

CROSS EXAMINATION (Continued)

BY MR. LYNCH:

Q. Dr. Schoeffler, at the conclusion of the session on Friday I believe we were discussing noise.

A. Yes, sir.

Q. The subject of noise generally.

I'd like now to move on to the next item that appeared in your definition, at least from the bottom; I believe you had indicated that the invention involved a matrix multiplexed pinball machine, et cetera, that had error recovery and noise prevention and noise immunity techniques.

A. More specifically, the microprocessor controlled pinball game that used matrix multiplexing of switches and some displays, and a combination of noise prevention hardware and noise immunity software, so that it would operate in real time with error recovery.

Q. Well, what I would like to do now is focus just briefly on error recovery and error recovery aspects of the invention.
And it appears from your testimony that there are basically two aspects of error recovery that occur as you discussed in Flicker and in the patent, and the first is compensation for stuck switches?
A. That is correct, sir.
Q. And that is accomplished, as I understand it, by use of a cleverly arranged matrix and the KBP instruction, correct?
A. No, sir.
Q. In general, how are stuck -- what are the error recovery techniques in hardware that are embodied in Flicker?
A. The principal source of error that we must guard against catastrophic failure of the game is the sticking of a single switch; that is, it is intolerable if a single switch sticks. Then the game stops.
The error recovery aspect of, in the Flicker game, is in both the hardware and the software.
In the hardware, there is the possibility of use of the single input test line so that as we scan through the switch matrix, we are testing one switch at a time and so if Flicker, if the program detects the switch closes for too long a length of time, it can ignore it, that is, realize it is stuck, and continue to operate on the

other columns of the switch.

So, one of the hardware capabilities is the fact that one of the input lines is a single row, so to speak; that is, one switch at a time is read.

The second aspect in hardware is the fact that when we arrange things, the switch is in the matrix, Frederiksen, of course, is reading the switches four at a time and so a critical switch that might stick and, hence, stop the machine, he can put in a single column of the matrix and, hence, even though he is reading four at a time, he is really reading only one. And that's a hardware prevention scheme because that's the way you wire the switches physically into the column of the matrix. Then the actual handling of the stuck switch problem is done in the software in the program.

Q. Okay.

A. So it is a combination of hardware noise prevention and software recovery.

Q. Okay. So we understand, it never discusses stuck switches per se in the patent, correct?

A. I don't agree with that, sir.

Q. Where does it discuss stuck switches in the patent?

A. In the various references I gave to real time response, it alludes to the successful operation of the system, and it would be apparent to an electronic engineer of that

time who was working with a pinball machine that catastrophic failures cannot be tolerated and the stuck switch problem was a well known problem in the pinball thing, so it would be apparent to an engineer, it would be inherent then in those sections.

Q. So the stuck switch disclosure is inherent in the specification, not express, correct?

A. Not quite correct, sir. It is inherent in the text of the patent. It is expressed in the program, which is part of the patent.

Q. Well, that's an issue?

A. Yes, sir.

Q. Okay, it is inherent in the text of the patent, correct? Now you are saying that of course there are two error recovery things; first of all, you provide a test line -- that's not a test line; here is the test line, isn't it?

A. That is correct, sir.

Q. And that gets read in one light at a time, and in fact, there's four ports to the microprocessor that look at these switches, and then there is a fifth port that looks at the test line, correct?

A. That is correct, sir.

Q. Do any of the accused infringing devices have test lines?

A. None of the accusing -- none of the accused infringing machines use the 4004 machine, so that particular arrangement

of a single line is not present in the other devices, but all of those devices differ from the 4004 in that they have good bit sensing instructions which are not present in the 4004, and that's why you use the test lines, so the fact that they have the different instruction set means that the equivalent is done and you would not need the test line.

Q. The equivalent is inherent in the machines that we use, the microprocessors that we use, is that what you are saying?

A. The ability to read a single switch is present in the hardware of each of the machines that are used in the other machines. It is explicitly present in the instruction set.

Q. We said the hardware that you said is used in this first compensation for stuck switches is the test line, correct?

A. That is one of the hardware items.

Q. The second hardware item, as I gather, is the arrangement of the matrix?

A. That is the way you wire the switches into the matrix, that is correct, sir.

Q. Could I call that arrangement of the matrix?

A. Yes, sir.

Q. Now, it still is the case, is it not, that as we went through, some of these switches could hang up the game?

A. The discussion we had about the hang-ups was if one of these improbable failures occur, the way the matrix is organized right there, the game could hang up.

If that were a real problem, the switch that would hang up the game would not be in that column.

Q. Well, you said that there was an improbable failure, for example, in the outhole column because these were vertical switches?

A. That is what Frederiksen said, sir.

Q. Do you know if the thousand bonus switch is a vertical switch on the machine?

A. No, sir. I was depending on Frederiksen's discussion of this, but it is clear that even if that were incorrect, that moving that outhole to the empty column would be an obvious

solution to that problem.

Q He never discusses that in the patent, but you said it would be an obvious solution, correct?

A. Frederiksen testified exactly to that point, and the examination of the matrix in the patent would make that apparent.

Q Fine.

Now, the software that compensates for stuck switches is what?

A. The debounce routine which requires that a switch open before it is detected closed a second time.

Q. The debounce routine.
A. -- is the key, and Frederiksen in addition applies the debounce routine on a column basis, which is part of the error recovery in software.
Q. Debounce routine on a column basis?
A. Yes.
Q. Now --
A. Excuse me, sir.
The test line would not be on a column basis. That would be on a switch basis.
Q. Because there are no columns, okay.
Would that then be the hardware and software that involves the first aspect of error recovery?
A. Yes, sir. I think that is it.
Q. Now, did you indicate that insofar as the test line is concerned that a stuck switch is recognized on the test line in Frederiksen's software, is recognized to be stuck?
A. It is my recollection that the test line software applies the debounce routine.
To be absolutely certain, I would want to go back and look at the program again, but that is my recollection, sir.
Q. Let's go to the second aspect of the error recovery.
Would it be fair to say that is the self-cleaning aspect?

A. Yes, sir, for lamps, digits, and solenoids.
Q. Self-cleaning for lamps, digits, and solenoids?
A. Yes, sir.
Q. Now, did you testify that self-cleaning is an inherent result of time division multiplexing?
A. No, sir. I testified that it was inherent in matrix multiplexing.
Q. Let's go back to the difference between time division multiplexing and matrix multiplexing, and let's recall again the lamps that were all arranged in a row that Mr. Frederiksen demonstrated, correct?
A. Yes, sir.
Q. They were time division multiplexed, correct?
A. They were.
Q. They were not arranged in a matrix, correct?
A. That is correct.
Q. Do they not exhibit that same self-cleaning function?
A. That particular arrangement of time division multiplexing is self-cleaning, but not all time division multiplexing would exhibit self-cleaning.

Q. Is self-cleaning inherent in cyclic and sequential time division multiplexing?

A. The context in which you're using the time division multiplexing is so broad that the answer has to be no.

Q. Well, when one takes an array, a linear array of lamps and cyclically and sequentially strobes them in a multiplexin fashion to turn them on, is he not accomplishing self-cleaning?

A. That's a very specific arrangement which is time divisio multiplexed, and that would be self-cleaning.

Q. So there's no reason why the matrix need be present to have this self-cleaning attribute, correct?

A. The matrix is not a necessary condition for self-cleaning; other structures can be run under software and provide self-cleaning, that is correct, sir.

Q. So self-cleaning is inherent in cyclic and sequential time division multiplexing.

A. No, sir. It would be -- it would be present in the one example you've given me, that is, the single line of lamps that Frederiksen described.

It is not inherent in time division multiplexing, whether it's cyclical and sequential, I don't believe, in general.

Q. Okay. Let's just, so we make sure we understand this, Doctor: If we were to have -- well, rather than draw...

MR. LYNCH: Do you have the large plaque of Fireball?

MR. TONE: We'll see.

BY MR. LYNCH:

Q. We'll go on and pick this up later.

Let's say it's inherent in cyclic and sequential muxing as in the light exhibit, the exhibit with the lights.

A. Well, the thing on the left refers to digits and solenoids also.

Q. It's inherent in cyclic and sequential multiplexing conducted as it was conducted in the light exhibit, correct?

A. Yes, sir.

Q. I'll put "Conducted as in lights exhibit." And is it your testimony it's always inherent in matrix multiplexing?

A. The matrix multiplexing as disclosed in the specification with the cyclical and sequential enabling of the columns, when you output to the lamps and the digits, and the solenoids the way Frederiksen does in his program, it is -- I'm not sure I would use the word inherent there; I think it's explicit. It's in the very nature of the multiplexing scheme.

Q. It's explicit?

A. (Witness indicating.)

Q. Does it ever say self-cleaning anywhere in the specification?

A. It's explicit in the operation of the -- of the matrix multiplexing with the cyclical and sequential enabling.
Q. Are there any other aspects to error recovery that exist in the patent or exist in Flicker?
A. There is no further error recovery that I -- that I recall being disclosed in the specification.
Q. Fine. Now, it is the case -- do you have a copy of the patent before you?
A. Yes, sir.
Q. -- that the test line arrangement is the subject matter of claims such as Claim 34. Is that correct?
A. Well, since 34 includes 33, it more properly begins in 33.

Q. So it is the subject matter of claims such as, e.g., 33 and 34?

A. Yes, sir.

Q. Now, when we talk about the arrangement of the matrix as you discussed here in the way Frederiksen arranged the matrix, you pointed out that the infringing, accused infringing devices don't have to use that arraangement because they have different microprocessors, is that correct, and can detect each switch closure?

A. Would you repeat your question, sir?

Q. Insofar as the arrangement of the matrix is concerned, you discussed that, in the context of the microprocessor involved. Now, in the microprocessors involved in the accused devices, it is possible to detect each switch closure independently, correct?

A. Yes. The fact that they may use different matrices and multiple matrices and the like is disclosed in the patent itself. When we discussed the microprocessors used in other machines, when they have different instruction capability, there is not the need of the test line as there was in the 4004.

Q. Okay. You say multiple matrices are disclosed in the patent?

A. Yes, sir.

Q. I will have to ask you where multiple matrices are dis-

closed in the patent, Doctor.

A. The first reference to multiplexing in the definition of the matrix multiplexing that is in the patent, I think it is in column 2, I have to look for the exact line, does not restrict the matrix multiplexing to single matrix. The restriction to a single matrix appears in the actual discussion of the actual embodiment, which does have a single matrix, and then secondly, when you look at a claim such as claim 46 which requires at least one matrix with two different kinds of things in it, namely, switches and displays, since that includes claim 45, it must be narrower than claim 45. And so the only possibility for this to happen is that claim 45 claims allows multiple matrices.

Q. But it is never - I am just -- just to be clear, there is no apparatus disclosed in the Flicker patent that has multiple matrices in it?

A. The apparatus disclosed is the Flicker design which has a single matrix. That's the original embodiment described in the patent.

Q. Let's go to the last aspect, and that is the real time aspect of the patent. Now, you mentioned many aspects of real time as set forth in the patent.

A. Yes, sir.

Q. Are the words "real time" found in the patent?

A. No, sir.

Q. So, I believe I asked you before, and perhaps you misunderstood me.
A. I misunderstood. And I thought they were. What actually is in the patent text over and over again is the word "response", which is fairly synonymous.
Q. Now, in your discussion of the patent, you said there are several instances where real time is referred to, or at least someone of skill in the art would know real time is being referred to, correct?
A. That is correct, sir.
Q. Can we put those together rather than going through them and summarize what the real time aspects of the patent are?
A. We can try.
Q. The first is you have to strobe the lamps fast enough that you don't have them flicker, correct?
A. Yes. A better way to word that would be so that they appear as though they are on continuously.
Q. Strobe the lamps fast enough to appear continuous.
A. Yes. That also applies to the digits.
Q. Let's say the displays, okay? Let's say strobe displays then. Strobe displays likewise?
A. Yes, sir.

Q. Now, what other aspects of real time are there?
A. The other, another group of reference refer to the detection of switch closures as though they were continuously monitored.
Q. Well, what you are saying is you have to detect the switch closures fast enough to give their response similar to the response that exists in the electromechanical game, correct?
A. At least that fast, to match it. The patent actually claims improved repsonse.
Q. But, if you were designing it, you would have to do it at least as fast to match the speed of the electromechanical game?
A. That is correct, sir, and not miss a closure. Fast enough and not miss one.
Q. And not miss a closure?
A. Yes, sir.
Q. We will get -- if one misses a program or has an arrangement that misses a closure, what happens?
A. The operation of the machine would be degraded slightly.
Q. Now, let's look at the time period that Mr. Frederiksen testified that he was dealing with. How long did he have in which to detect a switch?
A. You are asking me the number he talked about in his, in his testimony? He didn't actually testify to that. What he

said was that a switch closes, that is the minimum length of time of a closure of a switch, was on the order of 25 to 30 milliseconds. That's different from response time.

Q. I know, but he had 25 to 30 milliseconds to sense that switch closure?

A. No, sir. That's the length of time that the switch is closed. And if he detects it within that time, he does not miss it. But depending on what he has to do after he detects the switch, he may have less time.

Q. Now, did you make any measurements on the Flicker machine as to the time period of, time periods involved in the switch closures?

A. No, sir, except through the observation of the game, of the play of the machine.

Q. Do you know whether it would represent a problem in the year 1974 to detect a switch closure that would last as long as 30 milliseconds?

A. It turned out not to be a problem the way Frederiksen designed his hardware; namely, using matrix multiplexing in his software, in that, in that case it turned out not to be a problem, in his case. It would depend on how you approach the design of such a system, whether it would be a problem or not.

Q. Well, suffice it to say, 30 milliseconds is a relatively long time in the world of a microprocessor such as the 4004, isn't that correct?

A. If you were going to compare that length of time to the time of exclusion of one instruction in a 4004, it is a long time. But that's the wrong thing to compare it to. You have to look at the job that the control system is doing. It is simultaneously scanning switches, lighting lights, lighting digits, taking care of solenoids and calculating game scores. And so although that microprocessor does a lot of instructions, it's got an awful lot to do, and it is in fact very difficult to organize the real time program so that it will get around there and do it quickly enough. And that's why I said in that era, in that time, the digital logic designers were not familiar with real time programming, as they were not accus- tomed to designing with microprocessors, and they were not trained that way in school and, consequently, it would be very much a problem in the case of the pinball game.

Q. Okay. The problem, the real time problem, is detecting 30 millisecond switch closures, correct?

A. No, sir.

The real time problem is doing all of the things that have to be done in parallel in that pinball machine. That's one of them.

If you wanted to do that without doing the others --

Q. We'll make a list.

A. -- then, you see, it would be straightforth, like in a calculator, where one can just sit there and look at the switches; then you have time.

As soon as you put the other things in parallel, you cannot force those things, all right? And so to put down 30 milliseconds as a time is very misleading.

Furthermore, the 30 milliseconds is the time the switch is closed.

If you have to detect the switch closure and then do something about it, you may have to detect it earlier than the end of the 30 millisecond closure.

Q. Suffice it to say -- I mean, I'm trying to make a list, Dr. Schoeffler:

You want to strobe the lamps, you have to strobe the displays, both so they appear continuous and you have to, at the same time, detect 30 millisecond switch

closures, correct?

A. You have to do more than that.

Q. In addition to these -- we're going to make a list of everything that has to be done. Isn't that correct?

A. Yes, sir, you must detect the switch closure in time to carry out its action in its response time.

The fact that the switch is closed 30 milliseconds does not imply that you -- in all cases you would have 30 milliseconds.

Q. Okay. "Detect switch closures in time." Okay?

A. Yes, sir.

Q. Now, how long -- what is the parameter that you place on it that you have to respond in to a switch closure?

A. It I were designing a pinball game I would have to look at each switch closure and look at the game rules to see what had to be done, and that determines it. That is, it's not a number I can give you or a parameter, because it will vary from switch to switch.

Q. What are the numbers on Flicker? How fast --

A. Which switch are you talking about?

Q. Let's say the switch down the side alley when the ball comes out; the switches, as the ball exits on the side. What time period, what --

A. Excuse me, sir. The game rules when that switch is closed is to, what, give a score?

Q. Yes.

A. Okay. Then the response time is that is required from the time the switch is rolled over until a game designer's opinion about when the target lamp should light is the response time.

Q. How long is that, Doctor?

A. I'm not a game designer.

Q. You don't know?

A. No, I don't know.

Q. What is the time constraint on the thumper-bumper switch up here, the 1000 switch in the center?

A. In that case, in the Flicker you have to pull that solenoid while the ball is in contact so that that ring will come down and shoot the ball away.

And so the requirement would be that you actuate the solenoid while the ball is in contact. And so if you assume that the switch was closed for 30 milliseconds, that would be the time of contact; the response time of the system to start the solenoid moving would be 30 milliseconds. So presumably you would have to detect the switch ahead of that time in order to give the commands to the solenoid to kick it away. Otherwise it would bounce away with a little less oomph.

Q. Do you know what the required response time is on this, or are you only assuming?

A. I am not a game designer. I have not measured the required response time on any single switch.

Q. So you don't know the required response time on any single switch, correct?

A. Not on that machine or any of the others.

Q. So you don't know how difficult it would have been to accommodate that, do you?

A. On the contrary, I've been concerned with the design of real time systems since the early 1960's, all right?

And the design of real time software for applications like this is such that the timing and the control of concurrency is the dominant problem in software.

All my research, all my consulting has been in the area of how do you organize software to guarantee things like response time. And I know it is not easy.

Q. I understand that, Doctor. But when you're making such a design, the first thing you do is place a limit on what the response time is in time, in seconds or milliseconds or micro-seconds, correct?

A. If I were designing a game like Flicker, using Frederik-sen's invention, I would want to know those numbers, that is correct.

Q. And you would have to know those numbers, correct?

A. I would have to know those numbers.

Q. And my question to you is, you don't know those numbers, correct?

A. That's -- you're talking about me as an individual?

Q. Yes.

A. Yes. I do not know those numbers.

Q. Now, you listened to Mr. Nutting's testimony; Mr. Nutting's concern is that the machine is so slow, he was wondering how to slow down the microprocessor to the world of pinball.

Did you hear that testimony?

A. No, sir, I didn't hear Mr. Nutting's testimony.

Q. You didn't hear it?

A. No, I wasn't present for that.

Q. Did you read Mr. Nutting's testimony?

A. No, sir, I did not.

Q. Suffice it to say, then, what you are doing is, you are testifying that detecting switch closures in time is a problem, but you don't know the constraints on that requirement as far as actual time is concerned, correct?

A. What I am testifying is, it is a problem; when I see 64 switches on a playfield, that's a large number of switches to be scanning at a rate such that, even if you had 30 milli-seconds for each, that is the longest length of time, that would be -- that is a problem in a real time program with a

4004 microprocessor, if you are doing other things concurrently as you appear on the list.

And that I know for a fact.

Q Now, let's go to the next item.

What if you were to use a Motorola 6800 microprocessor, would the problems become less severe?

A. The advantage of a Motorola 6800 microprocessor,as far as this aspect of the design is concerned, gives you faster execution of individual instructions, and that you have more freedom in the way you organize the real time program.

This does not mean that if you misorganize that real time program you will not have great difficulties.

The problem with real time programing is, you set up these series of events that have to occur. Okay. You tell the programmer, the designer: "You must, in your program, come out here and do these instructions a thousand times a second to read switches; and you must come out here a thousand times a second to do these digits; and, oh, by the way, when a switch is closed you've got to come over here and calculate the scoring routines."

The scoring routines in some of the infringing machines, according to the depositions, take a quarter-second to carry out.

A quarter of a second is very long. And so if you are over there in a scoring routine, making sure that you

get back over here all the time to do the scanning is not straightforward.

So, as a consequence, you have more alternatives with the faster machine, but it does not make it easy.

Q. I understand.

Now, you metioned 64 switches. Do you know how many switches are actually hooked up in the Flicker machine?

A. I don't, but that's irrelevant to the way the program is organized.

This program was designed to handle a matrix that is 4 by 16, plus, of course, a possible other 16 in the test line.

And so it is -- whether the switches are there or not is immaterial to the whole operation and design of the system.

Q. But you don't know how many switches are actually hooked up in that matrix.

A. I have not counted the physical number of switches on Flicker, no.

Q. Are there any other aspects to the real time disclosure of the patent? You went through the disclosure of the patent.

Now, after, "Strobe the lamps fast enough to appear continuous; strobe the displays likewise; detect the switch closures in time" -- correct -- any other aspects to

the real time constraints of the machine?

A. Yes. Within the real time disclosures the response to the solenoid is mentioned, while the ball is in contact with the -- in contact with the bumper, for example.

Q. But that's part of detecting the switch closures in time to respond, correct?

A. Yes, sir. But so would the top two. In other words, when you detect the switch, you turn on the lamps. So it is a related kind of thing.

I would list it in the reference on the side here.

Q. You want specifically solenoids?

A. Yes, sir.

Q. Now, we already have indicated that that thumper-bumper or that bumper solenoid is the subject matter of a claim, correct, that is not in issue here?

A. That was, which claim, sir?

Q. Claim 50 or 51, if I am not mistaken. 51, perhaps.

A. Yes, sir.

Q. So this is claim 51?

A. For example.

Q. For example. Are there any other aspects to the real time disclosure of the patent other than strobing the lamps fast enough or strobing displays fast enough;detecting switch closures in time to respond with the displays, and specifically to respond with the solenoids?

A. Yes, sir. The operation of the game rules in real time is mentioned in the patent; namely, that is, one must, the microprocessor, while it is doing that, must also calculate through the game rules and carry them out in real time.

Q. You mean it has to add up the score, is that what you mean?

A. Well, when it detects a switch closure, it has to determine that a lamp is lit. It has to add up the score. It may have to set up for bonus calculations or new games. It may have to ring chimes, sequence, you know, a series of

lights. There is a tremendous volume of work to be done there, and that has to be added to the concurrent parallel tasks, okay, or you really misunderstand the level of effort that goes into one of these programs.

Q. Now, this additional response you are talking about takes place entirely in the software, correct?

A. That is correct, sir.

Q. And with each game, it changes, correct?

A. With each game it may change, yes, sir.

Q. Or it would hopefully change to some extent, you'd be playing the same game, correct?

A. Yes.

Q. So you would say that the other thing that the micro-processor must do is execute game rules, meaning bonuses and things of that nature?

A. In real time.

Q. Execute game rules, bonuses, et cetera.

Now, and this is software?

A. Yes, sir.

Q. Now, are there any other aspects to the real time disclosure other than strobing the lamps fast enough to appear continuous; strobing the displays; detecting switch closures in time to respond, specifically solenoids; and executing the game rules by adding up bonuses?

A. Yes, sir. All the error recovery is part of real time.

Schoeffler - cross

Q. Well, we treated error recovery independently so I don't want to double-count it. Isn't that fair to say?

A. May I see the second sheet?

If you put a title on the sheet such as "Real time to exclude your error recovery", it would be misleading, because I testified there are two aspects of real time; namely, response time and error recovery.

Q. Well, real time without error recovery?

A. That would be fine.

Q. Let's put other than the error recovery.

Now, when we talk about the first item, that is, strobing lamps fast enough to appear continuous, that's what we saw on Mr. Frederiksen's little lamp array, correct?

A. On his little array that was the purpose of the demonstration.

Q. To show that you can strobe lamps fast enough to appear continuous.

A. Yes. I believe that he created that exhibit also to show that it was technically feasible to do that without destroying the lamps, but also that they would appear continuous, sir.

Q. And the displays operate the same way, correct; that is, they are strobed and lit occasionally, but they appear continuous?

A. That is correct, sir.

Q. Now, let's focus on the displays for the embodiment in

1974. Was strobing displays fast enough to make them appear continuous a standard technique used in displays of calculators?

A. Calculators used that technique in that year, yes, sir.

Q. Is there any difference between the way calculators strobed the displays to make them appear continuous and the way the displays on Flicker are strobed to make them appear continuous?

A. They are, they are different in the sense that, of course, they are equivalent displays physically, being much larger and more power involved, larger physically. And they are strobed concurrently in the Flicker with all of these other things, whereas normally in a calculator, the displays are strobed only after all the calculation is complete.

Q. Is there anything different about the way they are lit?

A. From a calculator?

Q. Yes.

A. The power levels, the voltage levels are different.

Q. They are bigger?

A. They are bigger and they have more power.

Q. If you wanted to have a big calculator and use big displays, you'd have to use more power, correct?

A. If you wanted a calculator with big displays, you would use more power, yes, sir.

Q. So it is fair to say that the strobing of the displays

is as in calculators?

A. The strobing of the displays is as in large calculators.

Q. Okay. And insofar as detecting the switch closures in time to respond, the detection is accomplished in the patented technique by placing the switches in a matrix, correct?

A. That is the hardware connection of the switches in the patent.

Q. And then the matrices interrogate it, shall we say, or strobe it, correct?

A. That is correct, sir.

Q. Now, insofar as that is concerned, is it or is it not the case that up until that time switch closures on a keyboard in a calculator were detected by arranging them in a matrix and strobing them?

A. The keyboard -- the keys on a keyboard were arranged in a matrix usually without diodes. They were local, near, not remote sensed as in the pinball machine. There was no problem of noise due to concurrent power devices which would require, for example, offsetting in time, and all of the other noise prevention and noise immunity combinations that we have talked about.

So it is really a different kind of scheme for detecting switch closures.

Q. I understand there may be different aspects, but I'd like you to answer my question.

A. Yes, sir.

Q. Calculator switches were arranged in a matrix and were sensed by multiplexing the matrix?

A. Calculator switches were arranged in a matrix without diodes and were sensed via matrix multiplexing.

Q. So calculator switches were sensed by matrix multiplexing, correct? Correct?

A. The matrix multiplexing is slightly different from the way we are using the word because of the diodes is the only difference.

Q. Okay.

Now, of course, the diodes, these diodes you are talking about do not appear in Claim 45 as recited in Claim 45, do they?

A. Yes, sir. They do.

Q. Where?

A. Because of the reference to the operatively connected to the processor. They are explicitly displayed in the figure in the patent text.

Q. Operatively. Once again, were they disclosed by the word, operatively?

A. Operatively connected, yes, sir.

Q. No where else?

A. Not in Claim 45.

The word, diode, does not appear, because they are explicit in the figure going with the patent, they are explicitly present.

Q. Are these the total of real time constraints in the patent?

A. Those are all that occur to me at the moment, sir.

Q. Now, the final aspect of the invention is matrix-multiplexing, correct?

That was the first part of your definition. When I said the patent, I meant the invention. The final aspect of the invention, going

backwards through your definition -- we talked about noise, we talked about error recovery, we talked about real time.

Now, we have got to talk about matrix multiplexing, correct?

A. Well, we must include microprocessor control as key to the invention, and then there is matrix multiplexing in addition.

Q. I want to focus on matrix multiplexing just for a moment.
A. Yes, sir.
Q. Now, you have referred, Dr. Schoeffler, to matrix multiplexing.
You do concur with Mr. Frederiksen that multiplexing can be carried out without a matrix?
A. That is correct, sir.
Q. Cyclic and sequential multiplexing can be carried on without a matrix, correct?
A. That is correct, sir.
Q. In the Atarian, which we discussed in reference to Defendants' Exhibit 19-C, we had a linear array of switches, and they are multiplexed cyclically and sequentially, correct?
A. I would not use the word, array, for the Atarian. There were 80 switches in the Atarian.
Q. Lined up?
A. Lined up.
The word, array, I use synonymously with matrix. That is not a matrix, sir.
Q. Now, where did you find --
(Brief interruption.)
BY MR. LYNCH:
Q. Now, you have discussed the diodes that appear in the matrix, correct?
A. Yes, sir.

Q. Now, so the Court will understand, are there diodes that appear in the matrix of Fireball?

A. I cannot see it up there.

(Brief interruption.)

BY THE WITNESS:

A. Yes, sir.

BY MR. LYNCH:

Q. Do they appear in the switch matrix?

A. Yes, sir.

Q. Do they appear in the lamp matrix?

A. Yes, sir.

Q. Those diodes appear at each intersection, correct?

A. Yes. Each element in the lamp matrix and the switch matrix is connected between a column and a row -- I think that is what you mean by an intersection -- and has a diode associated with it, sir.

Q. Well, I think you had another drawing of that, but suffice it to say that if I have just placed two rows of a matrix here and I place the column wires this way, and a lamp --

Here we have in your Exhibit 11 --

MR. GOLDENBERG: I think that is our exhibit.

BY MR. LYNCH:

Q. In our Exhibit 11-E we have a simplified lamp matrix with the diodes at each lamp, correct?

A. Yes, sir.
Q. Are these the diodes about which you have been testifying?
A. Yes, sir.
Q. Are these diodes present in each lamp on Flicker?
A. I would have to go back and examine the circuit diagram, sir.
Q. Are they necessary in the switch matrix as well?
A. They are necessary in the switch matrix to eliminate sneak paths.
Q. Are they present at each switch in Flicker?
A. There are diodes in the switches in Flicker.
I would have to go back and examine the diagram to see if there was one where there could be no sneak paths and where the diodes were left out.
Q. Well, when you say diodes, are you referring to diodes as illustrated in 11-E in the lamp matrix or the switch matrix -- and the switch matrix?
A. Yes, sir.
Q. Do you know if they are present in Flicker in such an arrangement, in the lamp matrix in Flicker and in the switch matrix in Flicker?
A. It is my recollection that they are.
Q. Are they shown in the patent?
A. Yes, sir.

Q. Here is Figure 5. Where are the diodes insofar as they appear in the switch matrix in Flicker?
A. They are not all shown, of course, in the drawing for clarity, but the diodes are, representative diodes are shown -- is that a 90 or a 98?
Q. 98.
A. Yes. Item 98 shows one of the diodes.
Q. Now, Item 98, you indicate, shows one of the diodes, in each instance. You are implying that they would exist on each switch that way?
A. That is my understanding, and I believe that is what Frederiksen testified also.
Q. Can you look at Flicker and tell me whether you find diodes on each of the switches?
A. I could if I took the time, sir.
Q. Would it take a long time?
A. I don't know. I haven't tried it.
Q. I don't think it will take you very long to look at the switches and tell me if there are diodes on them. Well, let me show you Exhibit 50, and tell me if the diodes appear in the switch arrangement on Exhibit 50 which purports to be a drawing of the Flicker pinball game.
A. The diodes are not shown here. of course, you have to trace the entire circuit and --
Q. I show you also Plaintiff's Exhibit 52 and ask you if

they are shown on that. If you refer to the P-4 connector in the upper right-hand corner, not the uppermost right-hand corner, but above the arrnagement, the P-4 playfield connection.

A. I see some diodes there, sir.

Q. Are those the diodes to which you refer that exist in the switch matrix as shown in Exhibit 11-E?

A. I can't be certain, sir. This, the schematic for Flicker is so fragmented, based on these few that we use as exhibits, I can't tell.

Q. Well, suffice it to say -- well, is it your testimony or is it not your testimony that these diodes are essential to the operation of Flicker?

A. When sneak paths --

Q. That is the diode of 11-E and the switch matrix.

A. When sneak paths are present which would permit you to read a switch closed which was not closed, the diodes are essential.

If the switches are arranged in such a way that, for example, sneak paths were not available, then they would not be necessary in that case.

In general, if you fill a switch in to all the intersections, they will be necessary.

Q. I understand that. What you are saying is they are essential if you need them and they are not essential if

you don't?

A. They are essential -- that's exactly what I'm saying, sir. If sneak paths are present and they would be present if you fill in a matrix with the switches.

Q. So you are saying that if you had a matrix shown, as at the bottom of 11-E, that they would be essential to be in the arrangement as set forth in 11-E?

A. Yes, sir.

Q. Now, insofar as the matrix is concerned, when you testified about matrix multiplexing -- let me move this since we had a better drawing -- when you discussed matrix multiplexing and you designed the matrix, you defined the matrix as having a single wire that ran up from, for example, the switches to the lamps, correct?

A. What I testified was that is what defines a matrix, that you can trace a single wire that corresponds to the column and see all the elements in the set that are connected in that column, that is correct, sir.

Q. And that is what occurs in the Flicker game and in the patent, correct?

A. That is correct, sir.

Q. That is, if one traces the switches, for example, in the outermost column, one comes up -- well, let's trace it in this column -- one winds up with lamps in the same column.

A. Yes, sir.

Q. Now, you also earlier -- or, Mr. Frederiksen made a sketch which was marked as Plaintiff's Exhibit 384, that showed the row lamps, switches, and digits all in a single matrix, that is, sharing common columns, correct?

A. That looks like that -- it's a little hard to follow, but it looks like they're in a common column, common matrix.

Q. Now, the advantages of that, using the common matrix for switches, displays and lamps, is to save components, correct?

A. In the case of the 4004 microprocessor, which is a 4-bit microprocessor, that is an economical arrangement for that microprocessor.

It saves components, and equally important, the number of wires going into the noisy cabinet from the drive board.

Q. Suffice it to say, do any of the accused devices, any of them, use a single matrix in the context that it is shown

in Exhibit 384?

A. No, sir

Q. Now, in the patent there is mention on several occasions, there's use of the word "synchronous" or "synchronism." Do you recall that, Dr. Schoeffler?

A. Yes. I don't recall the places, but I recall the use of the word.

Q. What is meant by the matrix being synchronous as it's disclosed in the patent?

A. I think I would like to see the reference. Do you recall where it is, sir?

Q. Column 3 at line 49.

A. Thank you, sir. (Reading patent.)

I see that reference, sir.

Q. What is meant by synchronous operation?

A. This is the reference in the patent to the arrangement for actually turning on and switching from the one column of the matrix to the next and simultaneously turning on the digits and the lamps, so that you can take advantage of the slow turn-on transistors and cut down the size of the noise spike in that column.

That is the special hardware circuit arrangement that Frederiksen used.

Q. Well, what does the word synchronous mean?

A. At the same time.

Q. So when, of course, you are enabling a column that goes through lamps, switches and digits, you perforce are enabling it at the same time, correct?

A. No, sir. No, sir.

Recall that Frederiksen puts those slow turn-on transistors at the top of each column, and so if you have a pulse of current come through, you want that to come up very gradually to cut down noise.

That's part of the noise prevention scheme. And so what he has to do is pre-load which lamps are to be lit and which digits, and then do it all the same time so that all of these currents are smooth that way.

Q. I understand. But when they all do it at the same time, lamps, switches and digits --

A. Just lamps and digits.

Q. -- lamps and digits, I mean, when the lamps and digits are enabled at the same time, after being loaded in, they are operating synchronously.

A. They are turned on at the same time, that is correct, sir.

Q. And that is synchronous operation?
A. That's the specific reference to synchronous that's in this disclosure, yes, sir.
Q. That's right. So insofar as the low beta transistor is concerned and the slow turn-on transistor, we discussed that yesterday, correct?
A. I don't know if it was yesterday, but it was sometime in the past.
Q. Or it was Friday.
A. Yes.
Q. Now, we discussed that as 88, and another transistor in the position of 3 on my chart of Figure 5, correct?
A. That is correct, sir.
Q. Have you looked at the circuit of Mr. Frederiksen as far as its operation of the low beta transistor is concerned and as far as the slow turn-on transistor is concerned?
A. I noted where they were on the schematic, yes, sir.
Q. Have you looked at the delay imparted by those components in the actual circuit of the Flicker?
A. I have looked them up in the data books.
Q. What type of delay in time do those two transistors impart to each of those columns to convey the noise immunity and noise prevention about which you testified?
A. Well, first of all, there is one transistor per column. That is at the top. That is the slow turn-on transistor.

Q That's No. 3, the one that's in the position of 3, correct?

A. Yes, sir. And what that does is take a pulse of noise, which would normally jump up and be square and round off the corner by the length of the rise time or turn-on time of that transistor. It turns out to be nominally two and a half microseconds for the transistors there. Now, that's to rise to about 80 or 90 percent, so the actual rounding of the front of that current pulse would probably be on the order of five microseconds or six microseconds, something like that.

Q And you have done that by calculation?

A. By looking it up in the data book that defined those elements. That's a standard parameter of transistors.

Q The slow turn-on transistor in the matrix produces a rise time of five microseconds?

A. Nominally, yes, sir.

Q That's a correct designation, isn't it, the five microseconds?

A. Yes, sir.

Q How about the low beta transistor, what effect does it have?

A. The low beta transistor has the effect of limiting the peak current that can go into the lamps, so that if the filament is cold, instead of getting a huge current spike, you limit it to one that is safe so that filament will not be

destroyed.
Q. What type of limitation is introduced by that low beta transistor?
A. Maximum current through the lamp.
Q. Did you observe it, did you calculate it in the context of the circuit of Flicker?
A. The -- I looked up the circuits in the data books and went through the calculation. I don't have the numbers at my fingertips now. But I convinced myself that, so nominally when the lamp is cold -- I'm sorry, let me back up.
Nominally, a lamp has a certain rated current. And when it is cold, when you first turn on the lamp, the current will jump up five or six times what it will be if the lamp is hot. And the manufacturers give you a safety margin even beyond that so you won't destroy the lamp. And I convinced myself that with the arrangement in Flicker, that you would not exceed this safety margin when you turned on a cold lamp.
Q. Now, let me -- I believe, Dr. Schoeffler, the transistor that appears at the location 88, now, are you referring to that as a low beta or the slow turn-on transistor?
A. That is the low beta one. That is the one that drives the lamps and limits their current.
Q. So we can be certain, that's the low beta, and the one at point 3 is the slow turn-on transistor, correct?

A. The --

Q. That was not technique No. 3?

A. That is correct, sir. Now, of course, the row transistor also has the same effect as the column one, just for the lamps, however, because the low beta transistor also happens to have a slow turn-on -- but that doesn't affect the digits, so the columns one, both the lamps and the digits and the row one will affect the lamps only.

Q. What you are saying is the low beta transistor, which is the low beta transistor, which is the row transistor, --

A. That is correct.

Q. -- will affect the lamps only?

A. That is correct, because it is not supplying current to the digits.

Q. The other, the slow turn-on transistor, affects the lamps and the digits?

A. That is correct, sir. So it affects the size of the current pulse in the whole column.

Q. Now, is it your position that the slow turn-on transistor, which is that in the position of No. 3, causes the rise time of five microseconds?

A. That's about the nominal smoothing of that front end. It might be a little more.

Q. And the low beta transistor, you forget what the calculations yielded with respect to that?
A. To the precise peak current, I don't remember, but as I recall, it was less than the current of the cold lamp, yes.
Q. What percentage of the peak current did it limit it to?
A. I don't recall the number. Let me think just a second if it will come to mind.
(Brief interruption.)
BY MR. LYNCH:
Q. Well, when you say --
A. I don't recall the number for Flicker, but the number in one of the other machines I evaluated was it limited to about two, two and a half times the current.
Q. Now, the slow turn-on transistor, you said you evaluated the rise time as a function of the transistor, correct?
A. Well, I looked in the data book, and it gave me the turn-on time.
Q. Is it possible to make that evaluation without looking at the circuit in which that slow turn-on transistor exists?
A. I am afraid I don't understand your question.
Q. Can you look at the transistor alone absent the actual context in which it exists, the entire circuit in which it

exists, in order to determine the --

A. The turn-on time of the transistor is a common parameter that is measured by the vendor and guaranteed by them within some tolerance and is displayed in the data manual.

The effect of the circuits might be to slow it down even further if there are capacitors or other elements around it.

Q. So the matrix -- in the matrix you had the slow turn-on transistor, the beta transistor, and the diode.

You talked about the diodes earlier.

A. Yes, sir.

Q. You indicated you did not know if diodes arranged as in 11-E in the switch matrix existed in Flicker?

A. I did not actually look in the machine to verify that each one was there because it is -- I did not look in the switch matrix to verify if they were there.

Q. Now, is the use of such diodes to prevent sneak paths in matrices, is that a technique that was commonly known in 1974, or did Mr. Frederiksen discover the use of diodes in a matrix to prevent sneak paths?

A. I believe the use of diodes to avoid sneak paths was known in '74. How widely known, I am not certain.

Q. Did you look at, for example, the Bally Alley machine to see if it had --

It has a matrix, does it not?

A. No, sir. There are not in a matrix.

Q. I did not say the switch matrix.

A. Oh, I am sorry.

Q. It has a matrix?

A. Bally Alley -- I have to go back and look at my notes.

Q. We will move on, Doctor.

A. Okay.

Q. Insofar as the matrix multiplexing is concerned then, other than the grid arrangement; that is, the intersection of points, the grid arrangement inherent in the word, matrix; you regard the matrix multiplexing disclosure as embodying the slow turn-on transistor, the low beta transistor, and the diodes in the matrix?

A. No, sir. The matrix multiplexing is the physical arrangement of the elements in a matrix with the cyclical and sequential enabling.

What is required in addition to this is a combination of hardware, error prevention techniques, which are economical, and software noise immunity techniques such that it will operate correctly.

Frederiksen found that the slow turn-on transistor and the low beta transistor were economical hardware prevention techniques in his system, and together

with his noise immunity techniques in the program, it worked fine.

But all that is required in the invention is matrix multiplexing with some combination of noise prevention and noise immunity, so it works. The specific combinations will depend on the current technology and the exact design.

Q. Let's pursue what was involved in the technology.

Do you have a copy of the Intel manual, Dr. Schoeffler?

A. Not with me, sir.

MR. LYNCH: Your Honor, that is Exhibit 1-A, if your Honor has our --

THE COURT: I probably have about three copies.

MR. LYNCH: I think we asked the clerk to retrieve the one we gave your Honor on Friday.

THE COURT: Oh.

(Brief interruption.)

THE COURT: What is this?

MR. LYNCH: That is it.

THE COURT: This is it? No. This is --

MR. LYNCH: That is the Intel users manual. That is it, your Honor.

THE COURT: Yes, 1-A.

BY MR. LYNCH:

Q. Now, before we get to that, let me just -- how extensively did you examine the Flicker device as far as its circuits are concerned?

A. I looked at the circuits. I did not verify, wire by wire, that they were the same as the schematic, sir.

Q. Did you verify whether it has a single matrix or not?

A. By tracing the wires?

Q. By looking at the machine, however one does it.

A. I did not, sir.

Q. Referring to the Intel manual, then --

A. I don't have a copy, sir.

Q. Here is the original document.

A. Thank you.

Q. Now, the Intel users manual would indicate, does it not -- this was the manuel to be employed by people who bought the MCS4 microcomputer set and were seeking to implement it in an application, correct?

A. In February of '73. Of course, it changed, and it's republished again and again.

A more appropriate one would be the one at the time that the patent was filed.

Q. The 4040 manual?

A. That's the one that is actually disclosed in the manual, not this one.

Q. Well, we will get to it.

This one was back in February of 1973, some two years prior to the filing of the patent.

A. That's the date on the bottom of my copy.

Q. On Page 2 it indicates that there are three major advantages of Intel microcomputers, the first being "great system flexibility," it indicates, "with easy program changes, ability to expand or shrink the system results, and small size and low power requirements are a result."

A. That's what it says, sir.

Q. At the top of Page 2.

A. That's what it says.

Q. Now, are these advantages that are realized by the design of Frederiksen in adapting a microprocessor to computer?

A. In the microcomputer part of it, yes, sir.

Q. And it gave -- I believe you testified it gave flexibility, changing from game to game by just changing software, correct?

A. That has been one of the payoffs of the use of microprocessor control, yes, sir.

Q. So the greater system flexibility with easy program changes, et cetera, is an advantage that Frederiksen realized, just as the Intel manual indicated he would. Correct?

A. The Intel manual indicates the potential for doing that. It takes someone to understand what has to be done and actually to carry it out to realize this potential.

Frederiksen did know what to do, and he did realize this potential, yes, sir.

Q. And, similarly, he realized the advantage, the second advantage, "expediency of design because ROM programming is easier than random circuit design." Correct?

A. Yes, sir.

Q. Now, did Frederiksen provide diagnostics in his machine, the Flicker machine?

A. I do not believe he did, sir, in the program.

Q. Do the accused machines provide diagnostics?

A. It is my recollection that all later machines, when the microprocessors had additional power, when the technology advanced, they used extra power and space to do that, yes, sir.

Q. And could you explain what diagnostics are in a pinball machine, briefly?

A. Yes, sir.

Maintenance of an electronic device like this is very, very expensive out in the field because of the complexity of the whole insides of it. Finding people capable of doing it is difficult.

When the machine is not being played, if

your microcomputer has extra power, you can program it to do things such as light the lights in a known pattern, and then someone can look at the pattern and, if it deviates from the pattern that's displayed in the service manual, he knows, for example, that a light is burned out or a component has failed.

And so one attempts to write these extra programs, which have nothing to do with the operation of the game, to help at the maintenance stage.

Q. And those diagnostic programs would also help you find a stuck switch, wouldn't it?

A. If a switch were stuck, that would help you -- prior to the playing of the game -- help you -- make you realize that it was stuck when it would not be apparent from looking at it.

Q. So diagnostics will help you recognize the existence of stuck switches.

A. That is correct, sir. By "you," of course, we mean a maintenance person.

Q. The maintenance person.

And those diagnostics exist in all the accused games of Williams and of Gottlieb, correct?

A. It is my recollection that they exist in all of them.

Q. They exist in the Atarian as well, don't they?

A. I don't recall in the Atarian reading the complete manual to determine that, sir.

Q. Turn to 3, page 3 of the manual.

A. Yes, sir.

Q. It refers there to a number of examples of control functions for which the microprocessor can be used, and it talks about process control, and you discussed process control in your direct testimony, correct?

A. That is correct, sir.

Q. You discussed process control of, I believe, a glass manufacturing plant?

A. I mentioned that.

Q. How large was the glass manufacturing plant?

A. The size of the plant is an incidental in process control. It is the unit within the plant that is put under control. There may be hundreds of units, but a computer generally will only control one of those units.

Q. How large was the unit?

A. In -- how do you want large?

Q. Physical size.

A. Oh, physical size. The particular unit would have been about a typical dimension the size of the table in front of the bench here.

Q. Now, in those process control environments, there are typiclaly switches that have to be detected, correct?

A. In some control environments there are, especially manufacturing processes. In the case of the glass, there

were no switches. They were all analog or continuously varying variables.

Q. And those varied, either the switches or varying level signals are sent to the microprocessor, and it responds and tells the machine what to do?

A. No, sir. In the early '70's, microprocessors were totally incapable of handling those control functions.

Q. Well, let's talk about process control generally.

A. Using computers, sir.

Q. Using microcomputers, as indicated on page 3.

A. Yes, sir.

Q. Process controls.

A. They were not used in the process control industry until the earliest was 1975, and that way, that was radically different again from the way it had been used prior to that time in the continuous process industries in which I worked and consulted.

Q. Ah. Turn to page 171 of the manual, Doctor.

A. Yes, sir.

Q. It talks about an Intel microcomputer in process control does all the thinking for an automatic bottle-loading machine.

A. Yes, sir.

Q. That's process control, isn't it?

A. A bottle-loading machine, it is a process, that is correct, sir. It is not a continuous process, but it is a

process.

Q. It is not a continuous -- do you know this machine, Doctor?

A. No, sir, but that kind of a process would be more aptly termed a discrete process. But that's a small point.

Q. This machine has to sense bottles coming in, correct?

A. From the description here, it is not clear what it had to do, sir.

Q. Well, it is clear that it loaded bottles of different sizes, presumably with liquid.

A. It says it tells the machine how to load bottles of different sizes and when to perform each step in the loading process, but that's not a very specific description of what it is doing, whether, it could be displaying instructions to an individual to do it; it could be controlling it directly, the speeds and rates. None of these are spelled out.

Q. None of them are spelled out, but insofar as you would have a line of bottles coming in and you would have to fill them and stack them some way, that would be a real time system, would it not?

A. It could be a real time system, yes, sir, depending on exactly what control functions you carry out.

Q. And process control is in many instances a real time control system?

A. Absolutely,sir.

Q. Now, insofar as other items are discussed here, it discusses elevator controls on Page 3. Now, is elevator control a real time system?

A. If microprocessors were used in 1973 in elevator controls, it would be a real time system. But they weren't used in 1973 in real time control systems because they would not have met the codes of the elevator systems. Computers were not permitted becauseof safety restrictions to directly control elevators in 1973.

Q. Well, this just indicates that the MCS-4 can be used in elevator systems in February of 1973, correct?

A. The Intel manual says it can be used. I don't believe it was used in elevator control systems.

Q. How about highway and rail traffic control systems, are those real time systems?

A. Generally they are, and safety critical real time control systems.

Q. So the fact of the matter is that the Intel manual does tell you to use the MCS-4 computer chips set for real time control systems, correct?

A. The Intel manual suggests that it can be used for real time control systems; gives you no detail of how you would use it for real time control systems.

Q. Now, turn to Page 51. Now, Doctor, at the top of Page 51, it indicates the MCS-4 computer systems are often used

to replace random logic controllers in a wide variety of systems, correct?
A. That's what it says.
Q. And that's what Frederiksen did, correct?
A. No, sir. There were no, as far as I know, random logic control systems for pinball machines. They were all electromechanical logic.
Q. Isn't that random logic, though, electromechanical?
A. It is, but I don't believe Intel is referring to electromechanical logic.
Q. But it is random logic?
A. It is random logic, but it is not the random logic here, I don't believe.
Q. And it says, "In each of these systems the number of peripheral devices, such as keyboards, switches, indicator lamps, numeral displays, printer mechanisms, relays, solenoids, et cetera, may have to be interrogated or controlled", correct?
A. That's what it says, sir.
Q. Now, it is the case, is it not, that what Frederiksen purported to do was control switches, indicator lamps, numeral displays and solenoids?
A. Not what he purported to do; what he did do, is that.
Q. So he controlled precisely the elements that the Intel manual indicated he could control, correct?

A. He controlled the elements on a pinball machine. I don't know what they are referring to up there.
Q. Well, they are referring to switches, correct?
A. They are referring to keyboard -- oh, switches, yes. I stand corrected.
Q. And numeral displays?
A. That is correct, sir.
Q. And solenoids and lamps?
A. But I doubt that Intel would admit that they were telling you you could control all switches, all kinds of lamps, all kinds of numeral displays, all kinds of printers with this little microprocessor, sir. They are suggesting that it is feasible, I am sure, under certain circumstances.
Q. Fine. Now, when we get to the area of multiplexing, it indicates here that multiplexors must be added, correct?
A. What it says is that when the number of input lines is insufficient, multiplexors must be added.

Q Correct.

So, clearly, a device such as the 4004 and microprocessors in the area of time of 1973 contemplated that inputs would get into the microprocessor or outputs would come out of the microprocessor by a multiplexing technique, correct?

A. All computer systems from long before 1974 and microcomputers had to have some way of switching devices into and out of the computer.

In the case of the Intel statement right there, the use of multiplexer chips, as Frederiksen explained, was envisioned. That is not what was used in Flicker.

Q. I show you, Dr. Schoeffler, a copy of an article, "Microcomputers For Data Acquisition," by yourself and a Mr. Rose, dated September 1974, Exhibit 1-T.

Did you write this article, Doctor?

A We jointly wrote it, sir.

Q. You are responsible for its content then at least in part?

A. Equally responsible, that is correct, sir.

Q. I would like you to refer to page 67 of the article, Doctor.

A. Yes, sir.

Q. It says in the paragraph, the second full paragraph, beginning in the left-hand column:

"Secondly, the microprocessors of today suffer

from I/O pin limitation. Therefore, the memory and I/O are usually multiplexed over a common bus."

Correct?

A. Yes, sir.

Q. Now, does that refer to time division multiplexing?

A. It refers to time division multiplexing but not cyclically and sequentially strobing and things of this nature at all.

This is the conventional way one interfaces an electronic device, whether they be computers or microprocessors at all times. It has nothing to do with matrix multiplexing.

Q. The conventional way, though, is to multiplex, correct?

A. Multiplex in this sense, yes, sir.

Q. So the Court will understand what your sentence says, the Intel microprocessor, we could say, has either five or four lines that go into it, correct?

A. Well, the particular -- you are talking about the input port, sir?

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Q. Yes, the input port to the CPU chip.
A. Fine. I understand what you are referring to. It has four lines called data lines.
Q. Four data lines.
A. For that chip, yes, sir.
Q. It has the test line?
A. It has a test line.
Q. Let's forget about the test line. We could say there are five data lines, one or the other.
But at any rate, you could hook up that computer to four switches, correct, and say it is going to know when any given switch is closed, correct?
A. No, sir. You cannot run that chip without a program which must be in memory. So those lines --
Q. I understand.
A. -- cannot be connected directly to a switch, no.
Q. Those lines, let's say, can monitor four switches, correct?
A. The only way data can get into the microprocessor is along those four lines, and those four lines are used to get instructions from the memory, to get data from the outside, to send data to the lamps and everything else, yes, sir.
Q. Let me put it this way.
Your disclosure here talks about I/O pin limitation --

A. Yes.
Q. -- that refers to the fact that you only have four data lines coming into a 4004, and you may want to get more than four sources of data into the machine, correct?
A. That is correct, sir.
Q. So if you have more than four sources of data or more than four sources of output, perforce, you have to look at the different sources at different periods of time, correct?
A. No, sir.
Q. Well, that is one way to do it?
A. It is one, but what this says is where -- however you get the data and however you look at them, when you bring it into the computer, the four data lines into the computer at different instances of time are used for data, for address, for input, for output -- has nothing to do with what you are doing in the external circuitry, however.
Q. But it is time division multiplexing?
A. It is conventional time division multiplexing as used inside computer circuits. It has nothing to do with matrix multiplexing.
Q. But this is the same problem that is referred to here?
A. There it is much more narrow. They are referring to the connection of multiplexer chips in order to expand the number of lines and, hence, permit the use of this internal bus for data address, et cetera.

Q. I said the problem, Doctor.

The problem that is being solved with multiplexers on page 51 of the Intel manual is the same problem that you propose to solve with time division multiplexing in your article, correct?

A. I am not proposing anything. I am merely stating a fact of the way they are organized.

The pin limitation is removed through the use of multiplexer chips is what the vendor is saying.

Q. Or it can be removed by time division multiplexing as you suggest in your article, correct?

A. That is correct, sir.

Q. So one can use multiplexer chips or time division multiplexing to overcome the insufficient number of ports or the pin limitations of a microprocessor, correct?

A. I am sorry. I did not follow the question. There was an "or" in there that I did not follow.

Q. One can use multiplexer chips or one can use time division multiplexing to overcome the pin limitation problem that existed in the 4004?

A. The statement of your question is not quite appropriate.

You use the multiplexer chips in order to do the multiplexing or sharing of those input data lines. It is not an alternate.

Q. But one could use just pure time division multiplexing

without multiplexer chips?

A. In order to share the lines, you need some kind of an electronic device out there to switch from the various sources of data. I don't know what your question is driving at.

Q. You would use a decoder instead of a multiplexer chip?

A. Well, you have to connect the memories of the two, sir, of course.

Q. Yes.

Well, suffice it to say that the pin limitation problem is what is addressed here and what you addressed in your article?

A. That is correct, sir.

Q. Now, let's get down to keyboards on page 52.

It talks about scanning and debouncing a keyboard, correct?

A. Yes, sir.

Q. Now, we already indicatated that debouncing keyboards and debouncing switches was a standard process in 1973, correct?

A. The calculators scan keyboards and the claculators debounce the switches, that is correct, sir.

Q. We already went through the fact that the same debouncing technique is proposed by Prolog for a calculator as is used by Frederiksen in the pinball machine, correct?

A. We emphasized it, the difference introduced by the real time constraint; namely, that the number of times you could look at the switch in order to debounce it made them slightly different.

Q. Prolog did it how many times?
A. The Prolog system, as I recall, in the one programming example had a time loop, and another looked at it twice after a delay, that is correct, sir.
Q. The same as Frederiksen, correct?
A. Frederiksen looked at it only once. He first determined that it was opened, and then closed. The 0-1 algorithm.
Q. We'll determine that when we get to the Prolog matter again.
A. Yes, sir.
Q. When we get to scanning and debouncing of a keyboard, that was standard.

Now, at the bottom of Page 52 we have disclosed what type of arrangement for keyboard switches?
A. That is a matrix connection for the keyboard, sir.
Q. It's a matrix connection and is it not inherent in this disclosure, do you not understand that that is matrix multiplexing of a keyboard?
A. Yes, sir, subject to the constraint that only one key at a time be closed.
Q. This is matrix multiplexing of the keyboard. Isn't that correct?
A. That is correct, sir.
Q. And when you talk about one key being closed, you're talking about the KBP instruction?

A. No, sir. I'm talking about the fact that there are no diodes in the matrix, which would give you erroneous results when -- if there can be multiple closures at the same time possible.

Q. Those diodes as in Defendant's Exhibit 11-E --

A. That's right, sir.

Q. But without -- notwithstanding the diode presence or absence, it is the case that this is matrix multiplexing of a matrix of switches, correct?

A. In a keyboard, yes, sir.

Q. In a keyboard.

And furthermore, on Page 53 of the article, it specifically indicates in connection with a display that one should place the display and the keyboard in the same matrix.

A. It does not say they should; it says they can be.

Q. They can be placed in the same matrix?

A. Yes, sir.

Q. Now, then, insofar as the Intel article on three pages, it discloses matrix multiplexing, correct?

A. In a calculator, yes, sir.

Q. It discloses a single matrix for matrix multiplexing of both -- switches and -- inputs and outputs, correct?

A. As a potential application in a calculator environment, sir.

Q. But it discloses inputs and outputs in the same matrix, correct?

A. In this environment, yes, sir.

Q. And it discloses the use of debounce routines, correct?

A. It describes debounce routines, sir.

Q. Insofar as the matrix of the switches and displays are concerned, and the matrix multiplexing is concerned, does the matrix multiplexing function in the Flicker game, as described in the patent, function any differently than would the combined matrix of displays and switches shown in the Intel manual?

A. Yes, sir. The Flicker is not a large calculator.

The switches are remote, they're well away. The lamps are very high powered -- high power lamps; one does not read --

Q. Let's talk about the displays.

Go ahead.

A. I was going to say, one does not read the switches except in conjunction with time displacement of the rise time of the currents through the lamps, and all of the other noise prevention and noise immunity things.

It is not the same thing. And to say it is the same is very misleading.

Q. But insofar as the matrix multiplexing function is concerned, is it the same?

A. No, sir. I believe that the intent here is to describe the calculator application of matrix multiplexing where one does not overlap the displays and the sensing of the signals.

Q. Fine. If we were to refer to Claim 45 then, if we go through Claim 45, tell me what of the various constraints of noise prevention, error recovery prevention or error recovery capability and real time constraints you regard as inherent in that claim, in addition to the specific hardware recitations on the claim.

A. We are no longer talking about the pinball -- or the calculator in the MCS-4 manual?

Q. We will, but let's see if we can begin speaking about Claim 45.

A. All right, sir. May I ask you to repeat the question once more? I was speaking in terms of the calculator.

Q. Can you tell me which of the elements in Claim 45, which of the noise techniques, which of the error recovery techniques and which of the real time constraints you regard as inherent in Claim 45? Because as I recall, when we went through Claim 45 originally, very few, if any, of those were explicit except by the term "operatively."

A. So we are reading Claim 45 on the patent, or on Flicker, or what?

Q. No, no, I want you to tell me what noise techniques, what error recovery capabilities and what real time constraints you regard as being inherent in this claim in the patent. You continued to tell me that, for example, matrix multiplexing is inherent in this when you read it all

together.

A. Yes, sir.

Q. Now I want to read all of the things that are inherent in the claim. One, it says, a processor having a programming means and a memory means. Does that mean just having a processor having a program and a memory?

A. I don't understand your question. I'd like it clarified. For example, when we talk about noise prevention and noise immunity techniques, what we have said is there is a combination of noise prevention techniques in the hardware and noise immunity techniques in the software that worked together to carry out a satisfactory operation. But the particular ones are different in every machine that we would look at. And so --

Q. But this claim has to mean something. And what I want to know is what techniques does this claim require that one use.

A. If you, if the intent of your question is to ask which specific hardware noise prevention techniques are inherent in the claim independent of the machine we read it on, there is no answer to that question.

Q. Now here you are saying without looking at Cleopatra, you cannot tell me what noise prevention techniques are inherent in Claim 45?

A. The whole use of the word "inherent" is a set of hard-

ware things that would be apparent to an electronic engineer in 1974. My gosh, there are millions of things that were apparent to an electronic engineer. And so what one does is look for the ones that are in a specific device so that we have the combination of hardware prevention and software immunity so that I overcome this severe noise environment.

Q. Does the same obtain for the error recovery capabilities? Can you tell me what error recovery capabilities must be found in Claim 45?

A. There, the stuck switch problem is the dominant one that I am aware of in the pinball game. And this is directed, of course, to the pinball game.

Q. So insofar as noise is concerned, we have overcome that, or you have answered that. Now, with error recovery, which aspect of the claim inherently includes the stuck switch error recovery technique?

A. Item e.

Q. I have written, "Inherently includes stuck switch error recovery" opposite e.

A. Yes, sir.

Q. What stuck switch error recovery techniques are inherent in E?

A. There are recovery, the exact mechanism for doing the error recovery, the way -- whether a switch is stuck depends on the technology you are using, and it again will vary.

Frederiksen used one. Most of these machines used a different one.

Q. Most of these machines use different error recovery techniques, correct?

A. They used the same error recovery technique. The mechanism for determining that a switch was stuck was different in these because they couldn't economically use instructions to look at one switch at a time when Frederiksen could not. That's the only, only difference, is the technology in the particular microprocessor instruction set.

Q. Fine. So we understand each other, the accused machines, your testimony is, recognize the need for a stuck switch solution but used different techniques to accomplish that?
A. Used different program sequence and program organization, that is correct, sir.
Q. Now, the last item, real time constraints, which real time constraints do you regard as inherent in claim 45?
A. All of the real time constraints, sir.
Q. Well, for example, in claim 47, I believe, it indicates in particular that one should, could multiplex the displays so they appear continuous, correct?
A. Excuse me.
Q. Do the accused machines of Gottlieb mlutiplex the lamps so they appear continuous?
A. The Gottlieb machines do not multiplex the lamps, sir.
Q. How do they operate the lamps if they don't multiplex them?
A. They direct drive them using the equivalent of the multiplexer chips that were mentioned in the MCS-4 manual.
Q. They direct drive the lamps. In other words, they light the lamps the way they are lit in a flashlight, correct?
A. That is correct, with the exception that they are relit periodically in order to provide error recovery in case the wrong lamp was lit.
Q. And they are turned off occasionally when there is no

need for them any more according to the game rules, correct?

A. That is correct, sir.

Q. So as far as real time is concerned, where are the real time constraints, in which portion of the claim do the real time constraints exist?

A. You don't have all of claim 45 displayed there.

Q. No, I have got the rest of it here. I thought you'd handle one or two e while I've got it up; then I've got f, g and h here.

A. The real time constraints will show up, will start showing up in e. Those that are associated with the switches. And then will appear in the, the others also.

Q. They will appear in all of the remaining ones?

A. I have to read them, sir. Mine is not blown up by e, f, g divisions.

They will appear in f.

Q. Now, so we understand, in (e) --

MR. SCHNAYER: Excuse me, your Honor. Did he finish? I don't know if he finished his answer.

He just cut him off.

Did you have a chance to go through the rest of them and see if there were any others?

BY THE WITNESS:

A. They will appear in (g) and (h).

BY MR. LYNCH:

Q. Fine. Let's look at where they are in (e).

A. Yes, sir.

Q. It indicates that the processor, or that:

"The switches or response means are operatively connected to the processor for signaling the processor that the response has detected the ball."

A. That is correct, sir.

Q. Well, you would have -- the machine would have to know, or the processor would have to know that the ball is playing around on the field, correct?

A. That is correct. That means it must detect the switch in time to respond to it, is what it is saying.

Q. That's not what it says yet. It says just signaling.

A. The signaling means operatively connected in that claim means that they must -- must be connected to the

processor in such a way that it can determine the appropriate, with the appropriate response time, the closure of the switch, and not miss a switch.

Q. Okay. "Inherently includes response to switch in time." Right?

A. Yes, sir.

Q. And what technique is used for that?

A. The technique for determining that?

Q. In the Flicker game or in the --

A. In the Flicker. You have to speak to, now, a particular game.

In the Flicker game that is carried out by a combination of the matrix multiplexing and the combination-- the combination of hardware and software noise immunity, which allows the program then to sequence and synchronize and time things properly.

Q. Okay. In (f) are we talking about the real time constraint being the operative connection for activating the display in response to the signal?

A. That is correct, sir.

Q. And that's really the same response to the switch that we're talking about, correct, getting the display to respond in time to the switch.

A. Detecting the switch is an obvious prerequisite for that.

It also implies -- not implies -- but requires the calculation through the game rules to know which switch -- or, I'm sorry -- which display to be activated and how to activate it.

And it may also require timing signals into the future. If the game rules result in, for example, that you want three gongs sent out at a particular instant of time, it would -- so it requires much more than simply the detection of the switch.

Q. Fine.

"Multiplexing means operatively connected to the processor for cyclically and sequentially enabling the signaling means to signal the processor."

A. Yes, sir.

Q. Now, you read that to mean a matrix multiplexing, correct?

A. One or more matrix multiplexes -- one or more matrices which are matrix multiplexed, yes, sir.

Q. "One or more matrices."

Now, is there any other -- is there any real time constraint in (g)?

A. The real time constraint is associated with the overall program organization in order to do the others.

In other words, that multiplexing is done

under program control, in response to the switches, in order to display the others.

So this is, the claim has to be read on the total invention, not on the -- or, in total, not one word out of context from the rest of the claim, sir.

Q. Fine. Now, did you find that the rest of the real time, or the techniques used to make the accused devices operate in real time were the same as the techniques Frederiksen used?

A. Would you repeat that question once more?

Q. Did you find that the techniques that were used by the accused infringers to have the machine operate in real time were the same techniques as Frederiksen used in the Flicker and discloses in the patent, or supposedly discloses in the patent?

(Brief interruption.)

BY THE WITNESS:

A. The specific embodiment that Frederiksen disclosed in the patent, the specific embodiment is not used directly by the infringing machines.

But what I did was take each element in this claim, and I found a corresponding element in each of the infringing machines. That carried out substantially the same function substantially the same way and gave substantially the same results.

So I found that these claims do read literally on those machines.

BY MR. LYNCH:

Q. Well, let me then get to how when you came to the Atarian you concluded there was no infringement.

Now, insofar as the Atarian is concerned, does the Atarian use noise immunity and noise prevention techniques?

A. I did not pursue the investigation of the Atarian once I discovered that it did not use matrix multiplexing of switches, and, as a consequence, none of the claims we were reading would read on the Atarian. So I did not spend any more time studying the machine per se.

Q. Suffice it to say, item (g) -- if we were to read item (g) literally, just literally, as multiplexing means operatively connected to the processor for cyclically and

sequentially enabling the signaling means to signal the processor, does Atari have such a multiplexing means?

A. When you read literally multiplexing means in this patent, matrix multiplexing; it does not mean any of the other uses of that word. That is a literal reading of that claim as I understand the reading of the claims and the use of the word, literal, when we talk about the way a claim reads.

So, Atarian does not have matrix multiplexing of the switches.

Q. I understand that.

Let's not look at this patent.

A. Oh.

Q. Let me just ask you this.

Does the Atarian have a multiplexing means for the switches?

A. Yes, sir.

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Q. It has a multiplexing means that is operatively connected to the processor, does it not?
A. Yes, sir.
Q. That multiplexing means operatively connected to the processor in the Atarian is for cyclically and sequentially enabling the signaling means, is that not correct?
A. That is correct, sir.
Q. That is for the purpose in the Atarian to signal the response means that has detected the ball, correct?
A. That is correct, sir.
Q. Now, with respect to the Atarian, you discussed --
Before we get to the displays, did you have a chance to look at the Atarian?
A. No, sir. I did not.
Q. Did you have a chance to determine whether or not the Atarian uses matrix multiplexing of the displays?
A. No. As I said, I just dropped it when I found it did not -- the claim did not read on it.
Q. Okay.
A. I found it irrelevant.
Q. At any rate, do you know then -- we are up to this point -- that in the Atarian the multiplexing means is also for the purpose of cyclically and sequentially enabling the display activation means?
A. I don't know, sir.

Q. You do not know.

But you do know that insofar as up to the comma in item (g) the Atarian has a multiplexing means that literally responds to those words?

A. You are asking for the sentence labeled (g) irrespective of the rest of the claim?

Q. The words beginning at "multiplexing" and ending at the comma in (g).

A. And ignoring everything in (a) through (f) and everything in (h)?

Q. Ignoring the patent. Just tell me about the words, Doctor.

A. The Atarian does have that. It is not matrix multiplexing, but it is multiplexing in the other sense.

Q. It is multiplexing, and it is cyclic and sequential multiplexing?

A. Yes. It is not matrix multiplexing.

Q. Now, perhaps you can look at the Atarian brochure. At page 27, it indicates the score display circuit, it indicates that the connections to the score display panel are made in the form of a rectangular matrix with seven anode connections on one side and 28 cathode connections on the other. Figure 47 illustrates the arrangement of the connections in the multiplexed timing of the six vertical rows of digits, et cetera.

Can you tell me whether the Atarian has a matrix multiplexed display?

MR. SCHNAYER: What page are you on?

THE WITNESS: Page 27.

MR. LYNCH: That is Plaintiff's Exhibit 432, your Honor, for the record.

BY THE WITNESS:

A. The diagram looks very much like matrix multiplexing. The description is not quite complete enough, but it looks very much like it is, yes.

BY MR. LYNCH:

Q. So it is fair to say that we can place up on Exhibit 19-C Atarian switches multiplexed cyclically and sequentially, displays matrix multiplexed?

A. It appears that way from that description.

Q. Subject to correction, Doctor; we will put, "It appears."

Consequently, you came to the conclusion on Atari based upon the fact that the switches were not in a matrix, correct?

A. That is correct, sir.

Q. Without reference to error recovery, without reference to noise, without reference to real time constraints, without reference to debouncing switches and without reference to double sensing switches?

A. Matrix multiplexing in the microprocessor control are the heart and the prerequisite, yes, sir.

Q. Now, we also talked about Super Flight, Delta Queen and El Toro. Do you know if they used matrix multiplexing?

A. No, sir, the depositions I read did not go into any detail of the circuitry. I was -- they concerned the testing and the kinds of response that were observed in those machines.

Q. Now, I believe you testified, however, that Delta Queen, Super Flight and El Toro were not sufficiently operative to be regarded as complete?

A. I testified they failed, they appear to fail from the deposition, the noise test that would be essential for them to operate in the kind of noisy environment of an arcade of the pinball game, yes, sir.

Q. But you testified about that without knowing in any instance how those machines worked?

A. That is correct, sir.

Q. Returning them to the prior art briefly, we saw, I believe, Doctor, that the Intel manual did disclose several real time systems, correct?

A. It suggested.

Q. Suggested several real time systems?

A. Yes, sir.

MR. LYNCH: I'd like to mark, your Honor, the marked-up copy of Exhibit 45 as Claim 45 -- I'm sorry -- the marked-up version of Claim 45 as Exhibit 19-E, Defendant's 19-E. I will mark it, since it's two sheets, 19-E-1 and 19-E-2, E-1 being the portion with portions A through E of the claim, and 19-E-2 with the remainder of the claim.

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BY MR. LYNCH:

Q. Moving along, then, to precisely what else was discussed or suggested:

The Intel people apparently also put out an ad suggesting in two instances that their microcomputers, microprocessor be used for pinball machines. Correct?

A. Their ad mentions pinball machines, yes, sir.

Q. Mentions it two times, correct?

A. Yes.

Q. Now, you are also aware, are you not, Doctor, that there were a number of other disclosures in the 1973-1974 time frame that related to or that actually suggested microprocessor-controlled pinball machines, correct?

A. What do you mean by a disclosure?

Q. I'm referring to such items as the Electronics article, 1-E --

A. I'm sorry, sir. I was asking what you mean by the word disclosure.

Q. Talking about a printed article that circulated to the trade or circulated to the engineering or to the pinball community suggesting that microprocessor-controlled pinball was a viable thing to do.

A. I don't think this article discloses that.

Q. It doesn't even suggest it as a viable thing to look into?

A. It at best says there's a possibility for doing this.

There were no products on the market of this time, so that one would know, and there were none of these articles or disclosures, as you call them, that taught anything at all about how to do a real time system or a pinball game that I read among the ones that we went through earlier, sir.

Q. Well, your review of the art at that time, what did it indicate about any economic constraints that existed in the pinball market amongst the pinball machine manufacturers?

A. You're referring to the 17 articles that we went through, sir, that review?

Q. No. No.

I said, what do you know about the economic constraints that existed in 1973 and 1974 on pinball manufacturers that would have had an impact on their consideration of using a microprocessor to control a pinball machine?

A. The testimony of Frederiksen, where he indicated that he was not free, nor would the pinball manufacturer have been free, to upgrade the cheap components which were more than adequate and satisfactory with the electromechanical logic, but which were very difficult to work with when one comes to electronic logic, because of the noise they generate, the reliability questions, the cheap switches in particular.

So the one constraint I'm aware of was that

the electronic control system had to work with essentially the identical components.

This was in contrast, for example, to the automobile control system where you were free to change the components in the external device, which is a tremendous advantage.

Q. Well, answer me this, Dr. Schoeffler: Did you hear Mr. Frederiksen when he discussed his discussions with Mr. Nutting in which Mr. Nutting informed him that there were several big pinball manufacturers, and that Mr. Nutting couldn't possibly compete with those manufacturers; they had techniques for making these electromechanical machines, and that he at best could make one pinball machine, but he wouldn't be able to change the electromechanical logic fast enough to compete with those people.

Do you remember that testimony?

A. I read the testimony. I wasn't present for it, sir.

Q. Now, that is an indication that -- do you have any familiarity with the degree of the proficiency with which the major pinball manufacturers in 1973 and 1974 could assemble and market a pinball machine?

A. Yes, sir. They were very proficient. As in any high-volume manufacturing situation, electromechanical components, they were very proficient.

And I believe Frederiksen was referring to

the situation that, not being large, he would be under severe economic disadvantage in the electromechanical components, like the switches and the relays, et cetera.

I don't believe he was referring to the logic part.

Q. In 1972 would it have been economically possible in your opinion to use a microprocessor system in any pinball machine?

A. In 1972?

Q. Yes.

A. I don't know the manufacturing costs involved in the volume production, nor am I even aware of the volume in the pinball industry for such a game. I believe that is the basis for the answer that you are seeking.

I have not looked into any of the economic issues.

The only one I was concerned about is the constraint that arises -- the constraints it places on the designer of the electronics; namely, not to change those components, the electromechanical components.

Q. We will get to those in a moment.

Let me ask you this.

THE COURT: I think, Mr. Lynch, we have come to the point where we will have to recess.

YOu may stand down, Dr. Schoeffler.

THE WITNESS: Thank you.

(Witness temporarily excused.)

THE COURT: You might stand by at 2:00 o'clock just in case there is a sudden change in things, but aside from that, Friday looks like the only other possibility.

What was the date that we agreed we would resume?

MR. TONE: March 12th, your Honor.

THE COURT: March 12th. That is beyond everybody's problems.

MR. TONE: Yes, it is.

THE COURT: Then if I don't see you on Friday, I will see you on March 12th.

MR. TONE: Your Honor, we will need to clear out your jury room, I think, and that leads to the question of whether we should leave -- whether we may leave boxes and things somewhere in the vicinity.

THE COURT: You can leave boxes. You probably will not be able to get these machines out of here. As a matter of fact, since you might need them Friday, why don't you just cover them up as you have done. I do not think the jury will be distracted if they are covered up.

MR. TONE: All right.

THE COURT: You can leave things in the jury room as long as they are not either distracting or so bulky that they crowd the jury too much.

MR. TONE: All right.

Then Friday, either way, if we go Friday or if we don't, Friday evening, then I think we should remove-- we will want to remove some other materials and bring them

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back March 12th.

MR. LYNCH: Can we go back to Texas, your Honor, and will we be afforded enough time to get up here?

THE COURT: For Friday?

MR. LYNCH: Yes.

THE COURT: Oh, sure. As a matter of fact --

(Brief discussion off the record.)

THE COURT: Marty tells me that I have scheduled a criminal matter for Friday morning at 9:00 o'clock, which will take a couple of hours. So there is 11:00 o'clock. It would not be worth it. Forget Friday. Forget Friday, and I will see you on the 12th.

MR. GOLDENBERG: Judge, we would like to have an understanding that we will have access to this converted Flicker game during the period that we are away and want some assurance that it is going to be really preserved intact and not tampered with in any way.

MR. SCHNAYER: Of course. In fact, they have had five or six times extensively -- they have looked at it and have had -- I just want to make sure that we have reasonable time.

MR. GOLDENBERG: We will give you notice, sir, whenever we want to.

MR. SCHNAYER: I mean, there is a limit to how much we can sit here and, you know -- you guys have been poking

around. I do not want you to destroy it.

MR. GOLDENBERG: We might as well have this out. The investigation opportunities that we had available to us, we have really believed there is some reason to question about what is in that machine as contrasted to what the witnesses told you about. We need time to make an investigation and come up with the 100 percent assurance of whatever --

THE COURT: Well, let's arrange an inspection.

MR. GOLDENBERG: That's all we want, Judge. Mr. Schnayer is telling me that --

MR. TONE: We will have an inspection in which both sides are present and we will arrange it by agreement. I don't think we need to burden your Honor with that.

MR. GOLDENBERG: Thank you.

(Adjournment to March 12th, 1984, at 10:00 a.m.)